Rachel B. Fernandes

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Research Interests

- **Exoplanet Detection and Characterization:** Transits, Radial Velocity, Direct Imaging, Microlensing, and Astrometry
- **Stellar Characterization:** Photometry, Spectroscopy, Pre-Main Sequence Stars, and Isochrone Fitting
- **Exoplanet Demographics:** Detection technique-agnostic Population Studies, Time Evolution of Planetary Systems, Combining Surveys Across Detection Techniques
- **Protoplanetary Disks:** Modeling of disk substructures and near-infrared variability
- **Code Development:** End-to-end ("farm-to-table") demographic pipelines; stellar characterization through isochrone fitting and photometric modeling

Research Highlights

- First discovered that the **populations of young close-in (sub-)Neptunes are shaped by both atmospheric mass loss and migration** (Fernandes et al. 2025a)
- Developed the **first publicly available pipeline, *pterodactyls*, to detrend the light curves of young stars and recover transiting planets** in TESS Full Frame Image photometry (Fernandes et al. 2022)
- First to identify the **pile-up of giant planets at the snowline** by comparing Kepler, radial velocity, and direct imaging surveys (Fernandes et al. 2019)

Professional Appointments

July 2025 – Present	**Center for Exoplanets & Habitable Worlds (CEHW) Fellow** Pennsylvania State University Supervisors: Dr. Eric Ford & Dr. Suvrath Mahadevan
August 2023 – June 2025	**President's Postdoctoral Fellow** Pennsylvania State University Supervisors: Dr. Rebekah Dawson & Dr. Eric Ford
January – August 2020	**Visiting Graduate Fellow** California Institute of Technology/Infrared Processing and Analysis Center (IPAC) Supervisor: Dr. David Ciardi
May – August 2015	**Women In Science and Engineering (WISE) Summer REU** University of Cincinnati Supervisor: Dr. Michael Sitko

Education

Ph.D., Planetary Sciences 2017 – 2023	**Lunar & Planetary Laboratory, The University of Arizona** Advisors: Dr. Ilaria Pascucci & Dr. Gijs Mulders Thesis: Exoplanet Demographics Beyond Kepler: Giant Planets with RVs and Young Planets with TESS
B.Sc., Physics & Astrophysics 2013 – 2017	**University of Cincinnati** Advisor: Dr. Michael Sitko Senior Thesis: Modeling the Near – IR Variability of the Herbig Ae/Be Disk around MWC 480

Professional Affiliations

2025 – Present	Science Team Member, **Roman Galactic Exoplanet Survey Project Infrastructure Team (RGES PIT)**
2025 – Present	Science Team Member, **TRExS: Transits in The Roman (Galactic) Exoplanet Survey**
2023 – Present	Science Team Member, **The Habitable Zone Planet Finder (HPF) Spectrograph**
2023 – Present	Science Team Member, **NN–Explore Exoplanet Investigations with Doppler Spectroscopy (NEID) Spectrograph**
2021 – 2023	**NASA's Nexus for Exoplanet System Science (NExSS) Alien Earths**, The University of Arizona
2017 – 2021	**NASA's Nexus for Exoplanet System Science (NExSS) Earths in Other Solar Systems (EOS)**, The University of Arizona

Professional Activities & Service

2025	**Scientific Organizing Committee Member**, On the Shoulders of Giants Conference, Archivio di Stato - Torino, Italy
2023 – Present	**Co–Chair,** Exoplanet Program Analysis Group (ExoPAG) **Science Interest Group 2 (SIG2) – Exoplanet Demographics**
2023 – Present	**Climate & Diversity Committee** Department of Astronomy & Astrophysics, Pennsylvania State University
2023 – Present	**Center for Exoplanets & Habitable Worlds (CEHW) Seminar Organizer** Department of Astronomy & Astrophysics, Pennsylvania State University
2023 – Present	**Panel Reviewer** NASA ROSES Exoplanet Research Program (XRP)
2023 – Present	**Panel Reviewer** NASA ROSES Astrophysical Data Analysis Program (ADAP)
2023 – Present	**Referee** Nature, PASP, MNRAS, AAS Journals
2020 – 2022	**Executive Secretary** NASA ROSES Exoplanet Research Program (XRP)
2019 – 2023	**Department Life Committee** Lunar & Planetary Laboratory, The University of Arizona

Telescope Time Allocation

SPHERE at ESO's Very Large Telescope (VLT) *3 nights, Ongoing*

- Exploring the Edges of Young Transiting Planetary Systems: A Direct Imaging Survey for Long-Period Giant Planets (PI Fernandes)

NEID at WIYN Observatory *25 hours, Ongoing*

- The Evolving World of TOI-1726c: Tracking a Young Planet's Atmospheric Evolution in Real-Time (PI Fernandes)

HPF At McDonald Observatory *25 hours, Ongoing*

- Confirming a Young Long-Period Sub-Neptune (PI Fernandes)
- Searching for Rare Giant Exoplanets around M-Dwarf Stars (PI/Co-I Fernandes)

DoubleSpec, TripleSpec at Palomar Observatory *12 nights*

- Palomar Spectroscopic Survey of Young Stars (PI Christiansen/Co-I Fernandes)
- Palomar Spectroscopic Survey of Young Stars – M Dwarf Extension Pilot Study (PI Christiansen/Co-I Fernandes)

NIRSPEC at W. M. Keck Observatory *5 nights*

- Tracing Atmospheric Mass Loss in Hot Jupiters (PI Petigura; Knutson)

SpeX at NASA's IRTF *11 nights*

- M Dwarf Metallicity for Exoplanet Hosts (PI Hardegree-Ullman)
- Near-IR Variability for Protoplanetary Disks around Herbig Ae/Be Stars (PI Sitko)

PHARO (200'') at Palomar Observatory *5 nights*

- AO Follow-Up and Speckle Imaging of TESS Candidate Host Stars (PI Ciardi)

Goodman Spectrograph on SOAR *2 nights*

- Transmission Spectroscopy of Giant Exoplanets (PI Hardegree-Ullman)

Outreach & DEIA Leadership

2023	**Westinghouse Science Honors Institute (WSHI) Lecture Series** Pennsylvania State University
2023 – Present	**Towards A More Inclusive Astronomy (TAMIA) Working Group** Pennsylvania State University
2023 – 2024	**NASA AWESOM SAG – DEIA Best Practices Working Group** Pennsylvania State University
2022	**Tucson Initiative for Minoritized Student Engagement in Science (TIMESTEP)** The University of Arizona
2021 – 2023	**Project-Based Learning Opportunities And Exploration of Mentorship for Students with Visual Impairments in STEM (POEM)** The University of Arizona
2020	**Exoplanet Explorer** ExoPAG Executive Committee and the NASA's Exoplanet Exploration Program
2019	**College of Science Outreach Coordinator** The University of Arizona
2015 – 2017	**ScopeOut - Annual Telescope Outreach Festival** Cincinnati Observatory

Grants & Proposals

2025 – 2027	**URSULA - Uniform Refinement of Stellar Uncertainties Linked to Ariel** NASA Ariel Preparatory Science ($190,970)

Honors & Awards

2025 – Present	**Center for Exoplanets & Habitable Worlds (CEHW) Postdoctoral Fellowship** ($200,000), Pennsylvania State University
2025	College of Science: **Dean's Climate and Diversity Award** (Group), Pennsylvania State University
2025	**PI Launchpad**, NASA Ames Research Center
2023 – 2025	**Presidential Postdoctoral Fellowship** ($200,000) Pennsylvania State University
2023	**College of Science Award for Excellence in Scholarship** The University of Arizona
2023	**Lunar & Planetary Laboratory Graduate Excellence in Scholarship Award** ($500), The University of Arizona
2018, 2019, 2022	**Galileo Circle Scholar Fellowship** ($3,000), The University of Arizona
2019	**Curson Travel Award** ($2,000), The University of Arizona
2016	**Sarah Blank Greenholz Scholarship** ($2,000), University of Cincinnati
2015 – 2016	**Department of Physics - Physics Scholarship** ($2,000), University of Cincinnati
2015	**Women in Science And Engineering (WISE) Grant** ($5,000), University of Cincinnati
2013 – 2017	**International Outreach Scholarship** ($60,000), University of Cincinnati

Undergraduate Research Mentoring

2025 – Present	**Murron Polk**, Pennsylvania State University Project: *Demographics of Young Planets*
2025 – Present	**Andrew Hotnisky**, Pennsylvania State University/University of Florida Project: *A Scalable Pipeline for Discovering, Vetting, and Validating Exoplanet Populations in the TESS Continuous Viewing Zones*
2022	**Abhinav Vatsa**, The University of Arizona *Project: Searching for Planets around Low-Mass M-dwarfs*
2016 – 2020	**Dakotah B. Tyler**, University of Cincinnati Project: *Measuring the Accretion Rates of Herbig Ae/Be Stars With Disks*
2015 – 2018	**Ammar Bayyari**, University of Cincinnati Project: *Modeling the Structures in the Protoplanetary Disk around MWC758*
2016 – 2017	**David Luria**, University of Cincinnati Project: *Modeling the Structures of the Truncated Disk Around HD 58674*
2015 – 2018	**Monika Pikhartová**, University of Cincinnati Project: *Modeling The Occultation Events from the Innermost Disk Region of the Herbig Ae Star HD 163296*

Programming & Software Experience

- **Developed *pterodactyls***: a pipeline that detrends the light curves of highly active young stars, searches for transiting planets, and performs injection–recovery tests for demographic studies
- **Co-Developed *ysoisochrone*:** a tool that uses stellar isochrones to estimate the masses and ages (with associated uncertainties) of young stellar objects (YSOs) using a Bayesian inference approach
- Coding Experience:

➔	Python	➔	Mathematica
➔	SQL	➔	C++
➔	IDL	➔	R
➔	Unix/Linux/MacOS	➔	High Performance Computing

Teaching Experience

2025	**Planets and Planetary Systems (ASTRO 497 Special Topics)** Guest Lecture on Exoplanet Detection and Demographics
2019	**Earth – Evolution of a Habitable World (PTYS 170A1)** **The Physics of the Solar System (PTYS 403)** Teaching Assistant
2018	**Our Golden Age of Planetary Exploration (PTYS 206)** **Earth – Evolution of a Habitable World (PTYS 170A1)** Teaching Assistant
2017	**Planet Earth: Evolution of a Habitable World (PTYS 170A1)** Teaching Assistant

Talk Contributions (Invited Talks in Bold)

2025	• Towards the Habitable Worlds Observatory, Washington D.C. • **Caltech/IPAC Lunch Seminar**
2024	• TESS Science Conference 3, Massachusetts Institute of Technology • Exoplanets V, Leiden, The Netherlands **(Plenary)** • **SEEC Symposium: Pathways To Characterizing Non-Transiting Planets**, NASA Goddard Space Flight Center • **Undergraduate Colloquium**, University of Cincinnati
2023	• **Planetary Science Seminar Series**, University of California Berkeley • **Carnegie Earth and Planetary Laboratory Astronomy Seminar**, Carnegie Institution for Science • **Frank N. Bash Symposium**, University of Texas at Austin
2022	• **Caltech/IPAC Lunch Seminar** • **Center for Exoplanets And Habitable Worlds (CEHW) Seminar**, Pennsylvania State University • Harvard University Center for Astrophysics • **TESS Science Talk**, Massachusetts Institute of Technology • Boston University • NASA's NExSS Alien Earths All Hands Team Meeting

	• **NASA ExoPAG 25 Virtual Meeting**
2021	• **Carnegie Earth and Planetary Laboratory, Astronomy Seminar**, Carnegie Institution for Science • **Exoplanet Lunch Seminar**, Jet Propulsion Laboratory • Exoplanet Explorers (ExoExplorers) Science Series
2020	• **Quantitative Habitability Science Workshop** • Exoplanet Demographics Conference • Lunar & Planetary Laboratory Conference • Exoplanets III, Heidelberg, Germany
2019	• Caltech/IPAC Visiting Graduate Fellowship Lunch Seminar • **3rd Advanced School for Exoplanetary Science: Demographics of Exoplanetary Systems**, Vietri Sul Mare, Salerno, Italy • **Exoplanet Lunch Seminar**, Jet Propulsion Laboratory

List of Publications ORCID: 0000-0002-3853-7327; Total: 39; Citations: 833; H-Index: 15

Lead Author (*Indicates Students Directly Mentored)

8. *Hotnisky, A., **Fernandes, R. B.,** et al. 2025, to be submitted January 2026:
A Scalable Pipeline for Discovering, Vetting, and Validating Exoplanet Populations in the TESS Continuous Viewing Zones

7. **Fernandes, R. B.,** Johnson, S., et al. 2025c, accepted to PASP:
Are We There Yet? Challenges in Quantifying the Frequency of Earth Analogs in the Habitable Zone

6. **Fernandes, R. B.,** Kanodia, S., et al. 2025b, AJ, 170, 55f:
Searching for GEMS: Confirmation of TOI-5573b, a Cool Saturn-Like Planet Orbiting an M Dwarf

5. **Fernandes, R. B.**, Bergsten, G. J.. et al. 2025a, AJ, 169, 208f:
Signatures of Atmospheric Mass Loss and Planet Migration in the Time Evolution of Short-Period Transiting Exoplanets

4. **Fernandes, R. B.** & Hardegree – Ullman, K. K. et al. 2023, AJ,166, 175f:
Using Photometrically-Derived Properties of Young Stars to Refine TESS's Transiting Young Planet Survey Completeness

3. **Fernandes, R. B.**, Mulders, G. D., Pascucci, I. et al. 2022, AJ, 164, 78:
Pterodactyls: A Tool to Uniformly Search and Vet for Young Transiting Planets in TESS Primary Mission Photometry

2. **Fernandes, R. B.**, Mulders, G. D., Pascucci, I. et al. 2019, ApJ, 874, 81:
Hints of A Turnover at the Snowline in the Giant Planet Occurrence Rate

1. **Fernandes, R. B.**, Long, Z. C. et al. 2018, ApJ, 856, 103f:
Variability of Dust Emission in Pre-Main Sequence and Related Stars. IV. Investigating the Structural Changes in the Inner Disk Regions of MWC 480

Major Contributions

14. Bryson, S., ….., **Fernandes, R. B.**, et al. 2025, in review:
Why Estimating $\eta_\oplus$ Is Difficult: A Kepler-Centric Perspective

13. Glusman, G. I., ….., **Fernandes, R. B.**, et al. 2025, in review:
Searching for GEMS: The Occurrence of Giant Planets Orbiting M-Dwarfs within 100 pc

12. Hardegree – Ullman, K. K., ….., **Fernandes, R. B.**, et al. 2025, AJ, 170, 183h:
Scaling K2 VIII: Short-Period Sub-Neptune Occurrence Rates Peak around Early-Type M-Dwarfs
11. Deng, D., Pascucci, I. & Fernandes, R. B. et al. 2025, Joss, 10, 106:
Ysoisochrone: A Python Package to Estimate Masses and Ages for YSOs
10. Bergsten, G. J. ….., **Fernandes, R. B.** et al. 2023, AJ, 166, 234b:
No Evidence for More Earth-Sized Planets in the Habitable Zone for Kepler's M Versus FGK Stars
9. Christiansen, J. L., ….., **Fernandes, R. B.** et al. 2023, AJ, 166, 248c:
Scaling K2 VII: Evidence for a High Occurrence Rate of Hot Sub-Neptunes at Intermediate Ages
8. Bergsten, G. J., Pascucci, I., Mulders, G., **Fernandes, R. B.** & Koskinen, T. T. 2022, AJ, 164, 190b: **The Demographics of Kepler's Earths And Super-Earths into the Habitable Zone**
7. Koskinen, T. T., Lavvas, P., Huang, C., Bergsten, G., **Fernandes, R. B.** & Young, M. E. 2022, ApJ, 929, 52k:
Mass Loss by Atmospheric Escape from Extremely Close-in Planets
6. Bennett, David P., Ranc, Clément & **Fernandes, R. B.** 2021, AJ, 162, 243:
No Sub-Saturn Mass Planet Desert in the CORALIE/HARPS Radial Velocity Sample
5. Mulders, G. D., Pascucci, I., Ciesla, F. J. & **Fernandes, R. B.** 2021, ApJ, 920, 66:
The Mass Budgets and Spatial Scales of Exoplanets and Protoplanetary Disks
4. Pikhartova, M, Long, Z. C., Assani, K. D., **Fernandes, R. B.**, et al. 2021, ApJ, 919, 64:
Variability of Disk Emission in Pre-Main Sequence and Related Stars. V. Occultation Events from the Innermost Disk Region of the Herbig Ae Star HD 163296
3. Reddy, V., ….., **Fernandes, R. B.**, et al. 2019, Icarus, 326,133 – 150:
Near-Earth Asteroid 2012 TC4 Campaign: Results From Global Planetary Defense Exercise
2. Long, Z. C., Akiyama, E., **Fernandes, R. B.** et al. 2018, ApJ, 858, 112l:
Differences in the Gas and Dust Distribution in the Pre-Transitional Disk of a Sun-Like Young Star PDS 70
1. Long, Z. C., **Fernandes, R. B.**, Sitko, M.L., Wagner, K. et al. 2017, ApJ, 838, 62:
The Shadow Knows: Using Shadows to Investigate the Structure of the Pre-transitional Disk of HD 100453

Contributing Co-author

17. Taş, K. H. ….., **Fernandes, R. B.**, et al. 2025, in review:
An Earth-Sized Planet in a 5.4h Orbit around a Nearby K Dwarf
16. Veldhuis, H., ….., **Fernandes, R. B.**, et al. 2025, in review:
TOI-1259ab: A Warm Jupiter Orbiting a K-Dwarf White-Dwarf Binary is on a Well-Aligned Orbit
15. Koo, E., ….., **Fernandes, R. B.**, et al. 2025, in review:
Spectroscopic Characterization of LOFAR Radio-Emitting M Dwarfs
14. Giovinazzi, M. R., ….., **Fernandes, R. B.**, et al. 2025, in review:
The NEID Earth Twin Survey. IV. Confirming an 89 D, Msini=10m$_\oplus$ Planet Orbiting a Nearby Sun-Like Star
13. Giovinazzi, M. R., ….., **Fernandes, R. B.**, et al. 2025, AJ, 170, 52g:
The NEID Earth Twin Survey. II. Extremely Precise Dynamical Masses in Seven High-Acceleration Star Systems

12. Hotnisky, A., ….., **Fernandes, R. B.**, et al. 2025, AJ, 170, 1h:
Searching for GEMS: Two Super-Jupiters Around M-Dwarfs – Signatures of Instability or Accretion?
11. Han, T., ….., **Fernandes, R. B.**, et al. 2025, RNAAS, 9, 63h:
NEIDSpecmatch: Stellar Parameter Estimation with NEID Spectra using an Empirical Library
10. Stefánsson, G., ….., **Fernandes, R. B.**, et al. 2025, AJ, 169, 107s:
Gaia-4b And 5b: Radial Velocity Confirmation of Gaia Astrometric Orbital Solutions Reveal a Massive Planet and a Brown Dwarf Orbiting Low Mass Stars
9. Matson, R. A., ….., **Fernandes, R. B.**, et al. 2025, AJ, 179, 76m:
Demographics of M Dwarf Binary Exoplanet Hosts Discovered by TESS
8. Boley, K. M., ….., **Fernandes, R. B.**, et al. 2024, AJ, 168, 128b:
The First Evidence of a Host Star Metallicity Cut-Off in the Formation of Super-Earth Planets
7. Jones, S. E., ….., **Fernandes, R. B.**, et al. 2024, AJ, 168, 93j:
Close-in Neptune Orbiting the Active Mid M Dwarf TOI- 2015 with Transit Timing Variations
6. Polanski, A. S., ….., **Fernandes, R. B.**, et al. 2024 ApJS, 272, 32p:
The TESS Keck Survey. XX. 15 New TESS Planets and a Uniform Analysis of all Survey Targets
5. Zink, J. K., ….., **Fernandes, R. B.**, et al. 2023, AJ, 165, 262z:
Scaling K2. VI. Reduced Small Planet Occurrence in High Galactic Amplitude Stars
4. Osborn, H., ….. , **Fernandes, R. B.**, et al. 2023, MNRAS, 523, 3069o:
Two Warm Neptunes Transiting HIP 9618 Revealed by TESS & Cheops
3. Noonan, J. W., ….., **Fernandes, R. B.**, et al. 2019, AJ, 158, 313:
Search for the H Chondrite Parent Body among the Three Largest S-Type Asteroids: (3) Juno, (7) Iris and (25) Phocaea
2. Pascucci, I., Mulders, G. D., Gould, A. & **Fernandes, R. B.** 2018, ApJ, 856l, 28p:
A Universal Break in the Planet-to-Star Mass-Ratio Function of Kepler MKG Stars
1. Cheng, A. F.,..., Sitko, M. L., **Fernandes, R. B.**, et al. 2017, Icarus, 281, 404 – 416:
Stratospheric Balloon Observations of Comets C/2013 A1 (Siding Spring), C/2014 E2 (Jacques), and Ceres